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U.S. DEPARTMENT OF AGRICULTURE

ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Winterfat Fruits and Seeds Retain High Viability
3 Years in Cold StorageH. W. Springfield¹

Fruits and seeds of winterfat (*Eurotia lanata*) were stored 3 years in sealed and unsealed containers under four temperatures. Seed stored in sealed containers under refrigeration or subzero temperatures retained 93 to 99 percent viability. By contrast, seed stored in unsealed containers under room conditions retained only 46 percent viability, and under outside shed conditions, only 3 percent viability. Cold storage in sealed containers is recommended.

Keywords: Seed storage, winterfat, *Eurotia lanata*.

According to the early literature, winterfat (*Eurotia lanata* (Pursh) Moq.) seeds lose most of their viability within 1 or 2 years (Wilson 1931, Hilton 1941, U. S. Forest Service 1948). Recently we learned that fruits of winterfat remained more viable when stored at 38° to 42° F. than at 55° to 95° F., and that retention of viability varies with the year the fruits are collected (Springfield 1968a, 1968b).

We then undertook further studies to answer the following questions: (1) Should winterfat be stored as whole fruits or threshed seeds? (2) Should the storage containers be sealed or unsealed? (3) How does storage in an outside shed, where temperatures fluctuate widely, compare with storage in a freezer, a refrigerator, or under ordinary room conditions?

Methods

Fruits used in the study were collected November 1, 1968, from a group of plants at an

experimental site 15 miles west of Corona, New Mexico. Fruits were ripe, as indicated by ease of removal from branches and the large number on the ground from natural shattering.

Soon after collection, seeds were threshed by hand from about half of the fruits. Both fruits and seeds were then air-dried for 5 weeks. Moisture contents at the start of the experiment, determined by oven-drying small samples, were: whole fruits, 10.8; threshed seeds, 8.2.

On December 7, 1968, fruits and seeds were stored in an outside shed, a room, a refrigerator, and a freezer (table 1). In each storage area, half of the fruits or seeds were stored in an open, unsealed container and the other half in a sealed container. The sealed containers were 1-quart metal cans with quarter-turn lids, fastened with masking tape. Though not absolutely airtight, they were much less subject to humidity changes than the containers without lids.

Viability was checked at yearly intervals for 3 years. At the start of each viability test, whole fruits were threshed by hand to insure comparability between fruits and seeds (about 25 percent of the fruits did not contain seeds). For each storage situation, three replications of 50 seeds were put in petri dishes filled with 100 ml vermiculite and 60 ml distilled water.

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Two layers of germination blotter were put on top of the vermiculite. Seeds were placed on the blotters, which remained moist throughout the test. All germination tests were made in a refrigerator modified to provide a temperature of $56^{\circ} \pm 2^{\circ}$ F. without light.

Seedlings were counted at 1- or 2-day intervals. Seeds were considered germinated when cotyledons and radicles together measured at least 1/2 inch and both were detached from the seedcoat.

Results and Discussion

Cold storage resulted in higher retention of viability than room or shed storage (table 1). Viability was retained at the highest level in a freezer at -4° to -10° F. Storage under refrigeration (34° to 42° F.) also generally gave higher viability. The only exception was threshed seeds stored in unsealed containers, which dropped sharply in viability between the second and third years of storage. The exact cause of this drop is not known, but some external factor, such as additional moisture, probably was responsible. In any event, whole fruits retained their viability throughout the 3 years under

refrigeration, in sealed as well as unsealed containers.

Sealed storage usually gave advantages over unsealed storage, especially under the warmer storage temperatures (table 1).

Storage of winterfat seeds under room conditions generally proved unsatisfactory. Viability of threshed seeds declined appreciably after only 1 year of storage. Whole fruits, however, maintained near-maximum viability the first year. At the end of 3 years, whole fruits in sealed containers remained more viable than other fruits and seeds stored under room conditions.

Of the fruits and seeds stored in a shed outside, only threshed seeds in a sealed container retained reasonable viability. Whole fruits, especially those in an unsealed container, lost viability rapidly.

There were several inconsistencies in the responses of fruits and seeds to various storage situations. After 3 years of storage in sealed containers in a shed outside, for example, threshed seeds were 51 percent viable, but whole fruits only 11 percent viable. Under room conditions, however, fruits retained their viability better than seeds.

Table 1.--Percent viability of winterfat after 1, 2, and 3 years of storage in sealed and unsealed containers

Container and storage area	Temperature range	After 1 year		After 2 years		After 3 years		
		Fruit	Seed	Fruit	Seed	Fruit	Seed	Mean ^{1/}
	°F.	<u>Percent</u>						
SEALED:								
Outside shed	-15 to 105	81.3	82.0	20.0	70.7	10.7	50.7	30.7c
Room	75 to 83	97.3	78.3	81.0	63.3	62.7	42.0	52.4c
Refrigerator	34 to 42	100.0	91.7	94.0	100.0	97.3	93.3	95.3a
Freezer	-4 to -10	100.0	100.0	97.3	98.3	98.7	96.0	97.4a
UNSEALED:								
Outside shed	-15 to 105	18.7	47.0	0.0	12.3	0.0	6.7	3.4d
Room	75 to 83	96.0	83.3	72.0	52.0	44.0	48.0	46.0c
Refrigerator	34 to 42	98.7	96.7	97.7	98.3	96.0	79.3	87.6b
Freezer	-4 to -10	97.3	100.0	100.0	96.7	100.0	96.7	98.4a

^{1/}Means followed by same letter do not differ significantly at .05 level.

Conclusions and Recommendations

Storage in sealed containers either at sub-zero temperatures (-4° to -10° F.) or under refrigeration (34° to 42° F.) is recommended for maximum retention of viability of winterfat seeds. Sealed storage is preferable to open or unsealed storage, all factors considered.

In general, winterfat can be stored satisfactorily either as whole fruit or threshed seed. Threshed seeds stored unsealed under refrigeration might show large losses of viability in 3 years, however.

Winterfat fruits — but not threshed seeds — can be stored at room temperatures for up to 1 year with practically no loss in viability; this is an important consideration from the standpoint of economics and convenience. Storage under ordinary room conditions cannot be recommended for periods exceeding 1 year, however, because losses in viability are likely.

Storage under conditions comparable to the outside shed in this experiment should be avoided.

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